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Forever Solar

Retailer Forever 21 makes fashion statements every day with its trendy clothing, but the company recently also made a social commitment statement, with the installation of a 5.1-MW solar power system on the roof of its Los Angeles headquarters.

By Vicky Boyd

With more than 630 retail stores in the U.S., not to mention international operations, Forever 21 has made a fashion statement with its trendy apparel for the young at heart.

Now the clothing retailer has made another type of statement—one of social responsibility—with a 5.1-megawatt roof-mount photovoltaic system on its Los Angeles headquarters. When the project was completed in late 2014, it was the largest rooftop PV system in the more than 4,000-square mile Los Angeles County, with its population of over 10 million.

"Forever 21 was looking to reduce costs and be a good corporate citizen by supporting the city's renewable energy goals," said Jonathan Port, chief executive officer of Santa Monica-based PermaCity Solar. "It was really a big move and really made a landmark project. Forever 21 offset all of their electricity use and became carbon neutral in one large move."

In addition to designing and engineering the project, PermaCity also manufactured the patent-pending SolarStrap racking system that was used. San Jose-based SunPower Corp. furnished the PV panels.

Although the installation may be viewed as one large project, it actually was three 1-MW systems that fell under the city's Solar Incentive Program, each having its own meter. The fourth 2.1-megawatt system is tied into the Los Angeles Department of Water and Power's (LADWP) Solar Feed-in Tariff (FIT) Set Pricing Program, said Rusty Wood, vice president of Corona, California-based West Hills Construction Inc., the project's general contracting firm.

By doing so, it became the first project to take advantage of both programs at one location, Wood said.

About two years ago, Forever 21 sought information about possible solar installations from a number of companies, including PermaCity, Port said. Eventually, the Santa Monica solar company won the bid for the project.

"They were interested in solar, and we were assessing a number of their sites for them," he said. "They decided to look at their headquarters first."

Forever 21 leaders were aware of the city's FIT program, but Port said their goal originally was to just offset electricity used by the headquarters building.

The project started with the installation of a new thermoplastic polyolefin membrane (TPO) roof, Wood said. More than 200 mechanical penetrations that were no longer in use were removed beforehand. Altogether, workers spent about three months installing the new roof.

The new roof gave solar installers a blank slate on which to work while improving the building's overall energy efficiency.

"Many buildings in Southern California are ideal candidates for PV installation," Wood said. "In regard to this particular site, there's really no on-site shade obstruction, with very little near-site shade issues. It also stands alone apart from other buildings, dominating a very large portion of the street."

The Forever 21 headquarters appears to be one large building, but it is actually a building with multiple additions made over the years. That in itself posed challenges.

"Every building had different structural characteristics," Wood said. "It was like it was five different projects that each shared a wall."

Because you can't penetrate a TPO roof like you would a composite roof, a racking system with a different attachment method was needed.

The patent-pending SolarStrap allows solar arrays to be attached to a roof without a single penetration and without ballast, Port said, adding that although the straps weigh less than one pound each, they still provide "amazingly high strength" of up to 10,000 pounds—about 10 times stronger than ballast.

At the same time, the panels "are floating over the roof but are tied down to the roof and can withstand an earthquake," Port said. "I really had to think out of the box to do it, but it's really beautiful in its simplicity."

The LADWP Research Department certified the SolarStrap as meeting the wind loading required to handle Southern California's strong Santa Ana winds.



In addition to the high-efficiency E-327 SunPower solar panels, the Forever 21 project involved 19,500 PermaCity Solar Straps and 141 ABB 1,000-volt string-level inverters.

The racking system comprises four pieces that can be put together with one nut driver.

"The challenge I viewed as the designer is it had to be assembled in a matter of minutes, and the other concept was you only had to be able to use one tool," Port said. "The next step was it had to be a very fast way to tie it down to the roof and that system also had to be exactly compatible with the way roofs are made."

The SolarStrap allowed them to attach the panels flat to the 20-degree roof while also allowing the panels to be latitude specific.

"The high efficiency SunPower solar panels we installed are generating about 50 percent more output on the roof than standard efficiency panels would provide," Port said.

Maximizing efficiency per square foot is important when you have a constrained rooftop, said SunPower vice president Martin DeBono.

Altogether, about 630,000 square feet of the roof is under panels.

Summer temperatures in Los Angeles regularly top 100 degrees Fahrenheit, which can damage wiring out in the open. Because the racking allows the panels to float above the roof surface, the wiring could then be run behind the panels and kept out of the direct sun.

According to Port, the floating panels also allow air movement underneath, helping cool the modules and boosting efficiency.



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LADWP took about six months during a "long and very careful process" to approve the wiring plans for what would be the first 1,000-volt inverter system in the city, Wood said. "That's one of the things that allowed us to be successful," he said of the 1,000-volt inverter. "When you have systems covering a very large area, you need the 1,000-volt to minimize the voltage drop because the wires are traveling more distance. Most of the modern inverters are working with 1,000 volts. They're phasing out the 600-volt."

After the new roof was complete, solar installation began in April 2014.

Despite Los Angeles' infamous traffic congestion, Wood said it surprisingly wasn't that difficult getting equipment and materials delivered to the site. He credited continued communication between SunPower and West Hills as well as SunPower's logistics

provider for the ease of deliveries.

The site was conveniently located near several major interstates and there was no problem staging materials.

"There was a staging area within the compound that Forever 21 cleared out and allowed us to occupy at the south end of the project property," Wood noted.

In addition to the 15,512 super high-efficiency E-327 SunPower solar panels, the project involved 19,500 PermaCity Solar Straps and 141 1,000-volt string-level inverters from Zurich, Switzerland-based ABB.

West Hills was able to hire a number of workers through Homeboy Industries, which provides vocational training to former gang members.

The solar panel installation training and certification program, held in East Los Angeles, provides the needed education during a four-month plan.

"They were great workers," Wood said. "The program was very instrumental in getting a properly trained workforce. We always have to do on-site training with new hires, but this made it smoother and ensured our workers were up to speed as efficiently as possible."

Installation crews worked in a cascading pattern from north to south, with the first group snapping together all the railings. The next crew set up the racking, followed by another group that would set the panels and another responsible for the DC wiring conduit and conduit runs.

"At the same time, we had a lot of things running in parallel," Wood said.

As one system was completed, it was brought online to start generating electricity.

The two 1-MW projects on the south side, which were both part of the Solar Incentive Program, were run through existing meters. But the third SIP meter and the FIT meter on the north had to go through an old building substation.

Running wiring underground the half-mile to the southern meters wasn't an option because of a reservoir, drainage problems, and the cost of wire and conduit over that distance—the land was a former alligator farm, Wood said.

So project managers decided to upgrade the existing substation to a ground-mount facility. That work was finished in early December, with the remainder of the 5.1-MW project brought online late that month.

Port credited their overall success to the strong communication and work ethic of everybody involved. "I don't think we would have been successful without this great team," he said.

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